

Appl. No. 10/042,573
Amdt. dated 01/26/2004
Reply to Office action of 11/05/2003

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1.(previously presented) A process for removing a layer of silicon oxynitride, comprising:
 - providing a substrate and depositing thereon a layer of silicon oxynitride;
 - mounting said substrate on a platen and, using a polishing pad and a slurry, removing said layer of silicon oxynitride, thereby forming a fresh surface;
 - removing said polishing pad and then washing off any remaining slurry; and
 - with said substrate still on the platen, subjecting said fresh surface to a [high pressure] rinse by a solution that comprises a surfactant that modifies hydrophobic behavior, thereby removing from said fresh surface any and all residual particles of silicon oxynitride.
- 2.(original) The process described in claim 1 wherein said solution that comprises a surfactant has a pH between about 8 and 11.
- 3.(original) The process described in claim 1 wherein said surfactant is present in said solution at a concentration of between about 2 and 10 weight percent.
- 4.(previously presented) The process described in claim 1 wherein said fresh surface is subjected to said [high pressure] rinse for between about 5 and 20 seconds.

5.(previously presented) A process for removing a layer of silicon oxynitride, comprising:

providing a substrate and depositing thereon a layer of silicon oxynitride;
mounting said substrate on a platen and, using a polishing pad and a slurry, removing said layer of silicon oxynitride, thereby forming a fresh surface;
removing said polishing pad and then washing off any remaining slurry; and
with said substrate still on the platen, subjecting said fresh surface to a rinse by a solution that comprises tetramethyl ammonium hydroxide, thereby removing from said fresh surface any and all residual particles of silicon oxynitride.

6.(original) The process described in claim 5 wherein said solution that comprises tetramethyl ammonium hydroxide has a pH between about 8 and 11.

7.(original) The process described in claim 5 wherein tetramethyl ammonium hydroxide is present in said solution at a concentration of between about 2.5 and 5 weight percent.

8.(previously presented) The process described in claim 5 wherein said fresh surface is subjected to said rinse for between about 5 and 20 seconds.

9.(previously presented) A process for removing a layer of silicon oxynitride, comprising:

providing a substrate and depositing thereon a layer of silicon oxynitride;
mounting said substrate on a platen and, using a polishing pad and a slurry, removing said layer of silicon oxynitride, thereby forming a fresh surface;
removing said polishing pad and then washing off any remaining slurry; and
with said substrate still on the platen, subjecting said fresh surface to a rinse by

a solution that comprises isopropyl alcohol, thereby removing from said fresh surface any and all residual particles of silicon oxynitride.

10.(original) The process described in claim 9 wherein said solution that comprises isopropyl alcohol has a pH between about 8 and 11.

11.(original) The process described in claim 9 wherein isopropyl alcohol is present in said solution at a concentration of between about 10 and 50 weight percent.

12.(previously presented) The process described in claim 9 wherein said fresh surface is subjected to said rinse for between about 5 and 20 seconds.

13.(previously presented) A process for forming a tungsten stud in a silicon integrated circuit, comprising:

- providing a partially completed integrated circuit whose top layer is conductive;
- on said conductive layer, depositing a dielectric layer;
- on said dielectric layer, depositing a layer of silicon oxynitride;
- on said layer of silicon oxynitride, depositing a layer of titanium nitride;
- patterning and then etching said titanium nitride, silicon oxynitride, and dielectric layers to form a via hole that extends as far as said conductive layer;
- over-filling said via hole with tungsten whereby a layer of tungsten, having a first thickness, covers said titanium nitride layer;
- on a first platen, subjecting said tungsten layer to CMP until a second thickness of tungsten covers said titanium nitride layer;
- on a second platen, subjecting said integrated circuit to CMP until all tungsten outside said via hole has been removed and until said layer of titanium nitride has also been removed;

on a third platen, subjecting said integrated circuit to CMP, using a polishing pad and a slurry, until said layer of silicon oxynitride has been removed, thereby forming a fresh surface;

removing said polishing pad and then washing off any remaining slurry; and
with said integrated circuit still on said third platen, subjecting said fresh surface to a rinse by a solution that comprises a surfactant that modifies hydrophobic behavior, thereby removing from said fresh surface any and all residual particles of silicon oxynitride.

14.(original) The process described in claim 13 wherein said solution that comprises a surfactant has a pH between about 8 and 11.

15.(original) The process described in claim 13 wherein said surfactant is present in said solution at a concentration of between about 2 and 10 weight percent.

16.(previously presented) The process described in claim 13 wherein said fresh surface is subjected to said rinse for between about 5 and 20 seconds.

17.(previously presented) The process described in claim 13 wherein the step of subjecting said fresh surface to a rinse further comprises emitting said solution that comprises a surfactant from a dispenser at a flow rate between about 100 and 300 ml/min.

18.(original) The process described in claim 13 wherein said layer of silicon oxynitride has a thickness between about 300 and 1,500 Angstroms.

19.(previously presented) A process for forming a tungsten stud in a silicon integrated

circuit, comprising:

- providing a partially completed integrated circuit whose top layer is conductive;
- on said conductive layer, depositing a dielectric layer;
- on said dielectric layer, depositing a layer of silicon oxynitride;
- on said layer of silicon oxynitride, depositing a layer of titanium nitride;
- patterning and then etching said titanium nitride, silicon oxynitride, and dielectric layers to form a via hole that extends as far as said conductive layer;
- over-filling said via hole with tungsten whereby a layer of tungsten, having a first thickness, covers said titanium nitride layer;
- on a first platen, subjecting said tungsten layer to CMP until a second thickness of tungsten covers said titanium nitride layer;
- on a second platen, subjecting said integrated circuit to CMP until all tungsten outside said via hole has been removed and until said layer of titanium nitride has also been removed;
- on a third platen, subjecting said integrated circuit to CMP, using a polishing pad and a slurry, until said layer of silicon oxynitride has been removed, thereby forming a fresh surface;
- removing said polishing pad and then washing off any remaining slurry; and
- with said integrated circuit still on said third platen, subjecting said fresh surface to a rinse by a solution that comprises tetramethyl ammonium hydroxide, thereby removing from said fresh surface any and all residual particles of silicon oxynitride.

20.(original) The process described in claim 19 wherein said solution that comprises tetramethyl ammonium hydroxide has a pH between about 8 and 11.

21.(original) The process described in claim 19 wherein tetramethyl ammonium hydroxide is present in said solution at a concentration of between about 2.5 and 5

weight percent.

22.(previously presented) The process described in claim 19 wherein said fresh surface is subjected to said rinse for between about 5 and 20 seconds.

23.(previously presented) The process described in claim 19 wherein the step of subjecting said fresh surface to a rinse further comprises emitting said solution that comprises tetramethyl ammonium hydroxide from a dispenser at a flow rate between about 100 and 300 ml/min.

24.(original) he process described in claim 19 wherein said layer of silicon oxynitride has a thickness between about 300 and 1,500 Angstroms.

25.(original) The process described in claim 19 wherein said dielectric layer is silicon oxide.

26.(previously presented) A process for forming a tungsten stud in a silicon integrated circuit, comprising:

- providing a partially completed integrated circuit whose top layer is conductive;
- on said conductive layer, depositing a dielectric layer;
- on said dielectric layer, depositing a layer of silicon oxynitride;
- on said layer of silicon oxynitride, depositing a layer of titanium nitride;
- patterning and then etching said titanium nitride, silicon oxynitride, and dielectric layers to form a via hole that extends as far as said conductive layer;
- over-filling said via hole with tungsten whereby a layer of tungsten, having a first thickness, covers said titanium nitride layer;
- on a first platen, subjecting said tungsten layer to CMP until a second thickness

of tungsten covers said titanium nitride layer;

on a second platen, subjecting said integrated circuit to CMP until all tungsten outside said via hole has been removed and until said layer of titanium nitride has also been removed;

on a third platen, subjecting said integrated circuit to CMP, using a polishing pad and a slurry, until said layer of silicon oxynitride has been removed, thereby forming a fresh surface;

removing said polishing pad and then washing off any remaining slurry; and

with said integrated circuit still on said third platen, subjecting said fresh surface to a rinse by a solution that comprises isopropyl alcohol, thereby removing from said fresh surface any and all residual particles of silicon oxynitride.

27.(original) The process described in claim 26 wherein said solution that comprises isopropyl alcohol has a pH between about 8 and 11.

28.(original) The process described in claim 26 wherein isopropyl alcohol is present in said solution at a concentration of between about 10 and 50 weight percent.

29.(previously presented) The process described in claim 26 wherein said fresh surface is subjected to said rinse for between about 5 and 20 seconds.

30.(previously presented) The process described in claim 26 wherein the step of subjecting said fresh surface to a rinse further comprises emitting said solution that comprises isopropyl alcohol from a dispenser at a flow rate between about 100 and 300 ml/min.

31.(original) The process described in claim 26 wherein said layer of silicon oxynitride

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has a thickness between about 300 and 1,500 Angstroms.

32.(original) The process described in claim 26 wherein said dielectric layer is silicon oxide.